LITERATURE ON TELECOMMUNICATION (2000-2004) A BIBLIOMETRIC STUDY

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Certificate

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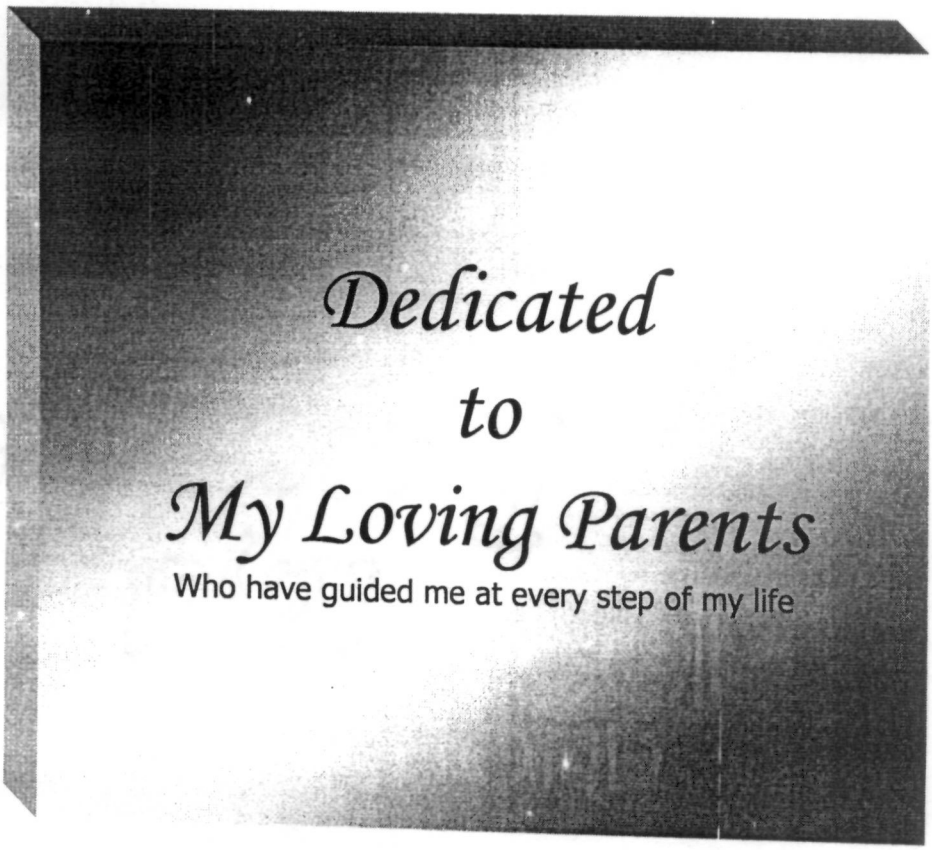
Dedicated
to
My Loving Parents
Who have guided me at every step of my life

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Chapter –1

Bibliometrics

CHAPTER -1

BIBLIOMETRICS

1. INTRODUCTION

Everything changes with the passage of time, same is the case with the subject library science. The library profession emerged as librarianship and changed to library economy, library science, documentation, library and information science, information science To understand the concept of bibliometrics, it would be imperative to know the concept of information science.

1. INFORMATION SCIENCE

Information science is an interdisciplinary science that investigates the properties and behaviour, of information, the force that governs the now and the use of information, and the techniques, both manual and mechanical, of processing information for optimal storage, retrieval and dissemination. This interdisciplinary science is derived from and related to such fields as Mathematics, Logic, Linguistics, Psychology, Computer technology, Operational research, Graphic arts, Communication, Library Science, Management and other similar fields. In brief, information science is an extension of library science and expansion of reference service.

2. BIBLIOMETRICS :INTRODUCTION

Information managers have adopted quantitative methods in recent years in order to evaluate library resources and services more objectively and effectively. Bibliometrics is one of the quantitative techniques applied by

library managers to measure the records of human communication. It is used to identify the pattern of publication, authorship, citations, used for a subject etc., over a period of time. Bibliometrics has gained significance in recent years because of its practical application in various library operations and services. It is estimated that out of total periodical literature published in library and information science at global level, 25% are on bibliometric studies.

2. ORIGIN AND HISTORY OF 'BIBLIOMETRICS

In the present context Bibliometrics has emerged as thrust area of research covering different branches of human knowledge.

The first study concerned with bibliometrics was conducted by 'Cole' and 'Eale' in 1917. They wrote "The History of Comparative Anatomy; Part-I: A Statistical Analysis". So the term for the first time used as 'Statistical Analysis'.

Hulme used the term 'Statistical Bibiliography' in 1923. According to him, "The purpose of Statistical Bibliography is to shed light on the process of written communication and of the nature and course of development of a discipline by means of counting and analyzing its various facets of written communication.

Henkle (1938), Gosnell (1934-44),Barker (1966) also used the same term i.e. 'Statistical Bibliography'.

The word "bibliometrics" first appeared in print in 1969 in Alan

Pritchard's article "Statistical Bibliography or Bibliometrics" in the December issue of the *Journal of Documentation.* Pritchard's article was the result of this judgment that the expression "statistical bibliography" should be replaced with a better term. He used "statistical bibliography" in his unpublished "Computers, Statistical Bibliography and Abstracting Services" and again in his *Statistical Bibliography: An Interim Bibliography,* published in May 1969. In December 1969, in "Statistical Bibliography or Bibliometrics" he stated, "The term [statistical bibliography] is clumsy, not very descriptive, and can be confused with statistics itself or bibliographies on statistics. As a result of the prompting of his friend, M.G. Kendall, Pritchard suggested that the word "BIBLIOMERTICS, i.e. the application of mathematics and statistical methods to books and other media of communication" be substituted for "statistical bibliography".

3. BIBLIOMETRICS: MEANING AND DEFINITIONS

The behaviour of information can be studies through bibliometrics. The term 'Bibliometrics' was used by A. Pritchard in 1969 to denote a new discipline where quantitative methods were employed to prove scientific communication process by measuring and analyzing various aspects of written documents.

Etymologically the term *bibliometrics* is composed of two distinct part i.e. *biblio* and *metrics.* The prefix *biblio* is Greek word which means books and *metrics* means measurement. So, Bibliometrics connotes the science of measurement pertaining to books or documents.

Diverse interpretation of the term has been put forward by many authors over the years.

(i) Raising (1962): "The assembling and interpretation of statistics-relating to books and periodicals... use of books and journals and to ascertain in many local situations the general use of books andjournals".

(ii) A. Pritchard (1968): "Application of mathematical methods to books and other media of communication".

(iii) D.T. Hawkins (1977): "The quantitative analysis of the bibliographic features of a body of literature".

(iv) R.A. Fairthorne (1989): "Quantitative treatment of the properties of record discourse and behaviour appertaining to it".

(v) W.G. Potter: "The study and measurement of the publication pattern of all forms of written communication and their authorship".

(vi) I.N. Sengupta: "Organization, classification and quantitative evaluation of publication patterns of all macro communication along with their authorship by mathematical and statistical calculus".

(vii) British Standard Institute (BSI): "The study of the use of documents and patterns of publication in which mathematical and statistical methods have been applied".

These definitions show that bibliometrics aims at the examination of the

statistical distribution of the processes relating to:

1. The utilization of documents.

2. Library staff, and

3. Library users.

It helps to evaluate 'information process and information handling in libraries and information centers'.

4. DEFINITION OF DIFFERENT ANALOGOUS TERMS

Bibliometrics is just one of the many sciences whose name ends with metrics. Many scientists have used the term under different names, but the concepts were more or less same. Some well established sub-disciplines like Scientometrics, Informetrics, Econometrics, etc. give some broader and narrower extension of human ideas.

4.1 LIBRAMETRICS

The term "Librametry" historically appeared first in 1948. It was suggested by great Indian library scientist Dr.S.R.Ranganathan. Under this term he suggested using of mathematical and statistical method for analyzing library activities and library resources. But this term did not take its place in library science and was forgotten for many years. Later it was called 'Librametrics'.

4.2 SCIENTOMETRICS

The term' Scientometrics' was suggested by two Russians named V. Nalimov and Z. Mulchinko in their book entitled "Scientometrics: the investigation of science as development of information process" in 1969.According to them Scientometrics is a complex of quantitative methods, which are used to investigate the process of science.

Scientometrics is a new emerging discipline which uses bibliometric measurement for evaluation of factors like scientific progress, levels of scientific development, social relevance and impact of the application of science and technology on society.

4.3 INFORMETRICS

The F I D's term 'informetrics' was suggested by German scientist Blakert and S.Z. Zygel in 1982 as a newly formed branch of science, using mathematical and statistical methods to investigate scientific and technical information on theoretical level and practical activities.

4.4 WEBOMETRICS OR CYBERMETRICS

Recently a new growth area in bibliometrics has been in the emerging field of Webometrics or Cybennetrics as it is often called. Webometrics can be defined as using of bibliometric techniques in order to study relationship of different sites on World Wide Web (www), such techniques may also be used to map out (called "Scientific Mapping" in the traditional bibliometrics

research area of the web) some other well established sub., disciplines like, Econometrics, Psychometrics, Sociometrics and Biometrics, etc.

5. BIBLIOMETRICS: SCOPE AND PURPOSE

It is said that bibliometric studies are generally based on quantitative measurements without any qualitative evaluation. They are, therefore, considered only as partial indicators of scientific progress.

Hulme, the pioneer of the study of 'statistical bibliography' clearly stated the purpose of bibliometrics as "To sheds light on the process of written communication and on the nature and course of development by a descriptive means of counting and analysing the various facets of written communication." It provides information about the structure of knowledge and how it is communicated. The scope of bibliometrics includes studying the relationship with a literature (citation studies) or describing a literature, typically, these descriptions focus on consistent patterns, involving authors, monographs, journals of subject/language.

It is a quantitative science and it is divided into two basic categories:

a. Descriptive bibliometrics (productivity count)

(i) Geographic

(ii) Time period; and

(iii) Disciplines

b. Evaluative bibliometrics (literature usage count)

(i) Reference count; and

(ii) Citation count

The descriptive bibliometrics further includes the study of the number of publication in a given field or productivity of literature in the field for the purpose of comparing the amount of production during different periods or the amount produced in.. different subdivisions of the field. This kind of study is made by a count of the papers, books and other writings in the field or often by a count of these writings which have been abstracted in specialized abstracting journals.

Evaluative bibliometrics includes the study of literature used by research worker in a given field. Such a study is often made by counting the references cited by a large number of research workers in their papers.

6. BIBLIOMETRICS IN RESEARCH

At present, it is an established technique covering wide area of knowledge which provides the background for more practical task. It has, therefore, been able to involve scholars from many of these disciplines. Consequently, it has, attracted scholars form different disciplines or their respective fields. Day by day, it is attaining sophistication and complexity having national, international and interdisciplinary character. It has established itself as viable and distinctive research techniques for studying science of

science based on bibliographic data. As a matter of fact, its backbone lies in its sound theoretical foundation most efficiently and effectively laid by some pioneers like Gross, Lotka, Bradford, Zipf, Derek J. de,, Solla Price, Bookstein, Massavesik, Cale brother, Pritchard, Garfiled, Hulme, Fairthorne and many others who are all not basically librarians, but belong to different branches of knowledge.

The techniques evolved by these pioneers are capable of throwing light on various complicated problems faced by many while handling information to quantify the process of written communication. It has established itself as a viable and distinctive measurement of human knowledge. Data analysis both of citations and of volumes of publications year by year can be useful in planning of retrospective bibliographies.

Bibliometrics also provides information about the structure of knowledge. Its classification studies give information about the subject, language and country relationship, which is based on literary warrant. Bibliometrics is very useful in any field of research or in any discipline or it-can be used in small and manageable ways by individuals, to improve some part of library or information service.

7. BIBLIO METRICS: ITS LAWS

Biblimentric laws are used to study:

1. Productivity of authors in terms of scientific papers (Lotka's Law)

2. Scattering of articles over different journals (Bradford's Law)

3. Frequency of occurrence of words in text (Zipfs Law)

These distributions are characterized as positively skewed, long tailed and reverse-J shaped. A similar characteristic is also observed in distributions relating to library size, citation of papers, book usage and obsolescence of literature.

While each law applies to different specific phenomenon, they all tend to demonstrate:> the same natural law - a few account for many. The three fundamental laws which laid the foundation of bibliometrics are:

7.1 Lotka's Law

Alfred J. Lotka was a mathematician, supervisor of mathematical research in the Statistical Bureau of the Metropolitan Life Insurance Company from 1924 to 1933. It was during this time, 1926, - that his -definitive work, later called Lotka's law was produced. His investigation was a Productivity analysis. Counting names and the number of publications listed for each, the coverage was for only A and B names in Chemical Abstracts for 1907 to 1916 and for Auerbach's Geschichtajelh der Physik from its beginning through 1900. The data were tabulated and plotted, from which Lotka developed a "general formula for the relation... between the frequency y of persons making x contributions"

$$\text{as } x^2 y = \text{const}$$

In 1926, Alfred J. Lotka proposed his Inverse Square Law correlating contributors of scientific papers to their number of contributions.

He was interested in determining "the part which men of different caliber contribute to the progress of science".

or $x^n y = \text{Constant}$

And for the special case n = 2, the constant is 0.6079 further he summarized the results as follows:

"In the case examined it is found that the number of persons making 2 contribution is about one-fourth of those making one contribution, the number making 'n' contributions is about $1/n^2$ of those making one and the proportion of all contributions is about 60 percent."

In other words, the number of papers produced (n) is inversely proportional to no. of authors (m) producing them.

If 100 authors make one contribution each

$100/2^2 = 25$ authors 2 papers

$100/3^2 = 11$ authors 3 papers

$100/4^2 = 6$ authors 4 papers

7.2 Bradford's Law

BRADFORD DISTRIBUTION

The now well-known British librarian and information scientist, Samuel

Clement Bradford, published a paper in 1934 based on analysis of bibliographies in applied geophysics, covering 1928 to 1931, and lubrication, from 1931 through June 1933. He identified a pattern in the production of articles by journals that has become known as Bradford's Law-also referred to as Bradford's Law of Scatter, Bradford's Law of Concentration and Scatter, or Bradford's Law of Dispersion. The two versions of Bradford analysis-the "verbal formulation" and the "graphical formulation" comprised one of the major laws of bibliometrics and have considerable theoretical relevance to serials collection management. In his verbal formulation, Bradford wrote:

> The law of distribution of papers on a given subject in scientific periodicals may thus be stated: if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as $1:n:n^2$.

In essence, a few titles are cited many times, and many titles are cited a few times. This phenomenon is technically termed *concentration* and *scatter*.

Bradford organized the journals he studied into three zones. For applied geophysics, 9 journals produced 429 articles in the first zone, 59 journals accounted for 499 articles in second zone and 259 journals produced 404 articles in the third zone. Thus, the ratio of journals in the three zones is 9:59:259, which is reducible to approximately 1:6:29. In the three zones for the subject of lubrication, 8 journals produced 110 articles, 29 journals produced

133, and 127 journals produced 152 articles-for a journal ratio of 8:29:127, which is roughly reducible to 1:4:16.

Bradford's law has been shown to be applicable to bibliographies as well as to larger aggregates of literature. The law has been applied to studies of dispersion of literature, mostly in the field of Science, Engineering and Medicine. Most of these are citation studies which consist of ranking of journal titles on the basis of the frequency of citations made of those titles in published literature.

Ranked list of journals can be used as a tool in the development and management of journal collections in libraries. Studies on the scattering of literature enable designers and managers of libraries and information centers to ensure the following type of questions

(1) What would be the cost of collecting all the journals relevant to a given topic?

(2) What fraction of the total coverage would be available at any specified limit of cost?

(3) What is the optimum distribution of journal collections as between a central reference point and satellite developmental or regional collections?

(4) How can a given collection best be subdivided into collection of primary, secondary and tertiary relevance or into stores requiring

frequent, occasional or only rare cases.

7.3 Zipf's Law (Frequency of occurrence of words in text)

Zipf derived his law from the empirical law of least effort. He said that there is relationship between the rank of a word and its frequency of textual matter if the words are arranged in their decreasing order of frequency of occurrence in a long text. According to him "in a long textual matter if the words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the words.

If 'r' is the rank of a word and 'f is its frequency, then mathematically Zipf s law can be stated as follows.

rf = c, where' c' is constant.

He found that by multiplying the numerical value of each rank (r) by its corresponding frequency (t) that is constant throughout its text e.g.

Rank (r)	Frequency (t)	Product = C
1	400	400
2	200	400
3	133	399
4	100	400
5	80	400

The above table shows distribution of words inversely proportional to the frequency of occurrence of the word.

Other Laws

The three other important laws that need to be mentioned here are:

7.4 Price's Square Root Law of Scientific Productivity

Derek J De Solla Price gave this law in 1963. According to this law "Half of the scientific papers are contributed by the square root of the total number of scientific authors".

7.5 Garfield's Law of Concentration

Eugene Garfield enunciated this law in 1971. This law states, that "A basic concentration of journals is the common core of nucleus of all fields."

7.6 Sengupta's Law of Bibliometrics

Sengupta has put this law forward in 1973, which is also known as off setting weightage formula for re-ranking periodicals to avoid discrimination against new journals, which necessarily have fewer citations credits. This is basically an extension of the Bradford law.

It states that "during phase of rapid growth of knowledge in a scientific discipline, articles of interest to that discipline appear in increasing number of periodicals distant from that field".

Mathematically this law stands in the following form:

$$F(x+y) = a + b \log (x+y)$$

where f (x+y) is the cumulative number of references in the first (x+y) most productive journals, x indicate number of journals in the same discipline and y stands for number of journals of unrelated discipline (y > x) and a and b are two constants.

8. SUBDIVISIONS OF BIBLIOMETRICS

- Operation Research (Linear Programming, Transport problems)
- Statistics (Multivariable techniques, trends, correlation).
- Bibliometric Laws (Laws of Zipf, Lotka and Bradford).
- Citation Analysis (Networks, Science Policy).
- Circulation theory (Models).
- Information Theory.
- Theoretical aspects of Information and retrieval.

9. BIBLIOMETRICS: ITS APPLICATIONS

The techniques of bibliometics have extensive applications equally in sociological studies of science, information management, librarianship, history of science including science policy, study of science and scientists and also in different branches of social sciences.

Some of the area where bibliometric techniques can be used are:

(i) to identify research trends and growth of knowledge.

(ii) to estimate comprehensiveness of secondary periodicals.

(iii) to identify users of different subjects.

(iv) to identify authorship and its trends in documents on various subjects.

(v) to measure the usefulness of adhoc and retrospective SDI services.

(vi) to forecast past, present and future publishing trends.

(vii) to develop experimental models correlating existing ones.

(viii) to identify core periodicals in different disciplines.

(ix) to formulate an accurate need-based acquisition policy within the limited budgetary provision.

(x) to adopt an accurate weeding and stacking policy.

(xi) to initiate effective multi-level network system.

(xii) to study obsolescence and dispersion of scientific literature (clustering and coupling of scientific papers).

(xiii) to predict productivity of publishers, individual authors, organizations, country or that of an entire discipline.

(xiv) to design automatic language processing for auto-indexing, and

abstracting and auto-classification; and

(xv) to develop norms for standardization.

10. LIMITATIONS IN APPLICATION

Though most of the studies tend to support the Bradfords distribution, some other researcher could not get the satisfactory results. Gross found that the scatter of research paper among physics journals deviated from that predicated by Bradford's Law. Out of 50 Bibliographies studied by Chonez, only six followed the law. Therefore, he calls the law pseudo scientific.

10.1 Lotka's Law

In the case of Lotka's Law it was found to fit in most cases. However the value of indexing was found to vary for different groups of scientists.

Another problem with Lotka's Law is that it totally ignores the potential authors who have not produced any publication so for.

10.2 Citation Analysis

In case of Citation Analysis, the common arguments against it are:

(1) Too much of self-citation and in house citation.

(2) Practice or citing only to get the favour of the powerful or to appease others.

(3) Citation given just to dress up the paper.

(4) Variation of citation rate during lifetime of paper.

(5) Variation of citation rate with type of paper and speciality.

(6) Negative citation.

11. CONCLUSION

Bibliometric analysis, has now become a well established part of information research, and quantative approach to the description of documents and examination of services is gaining ground both in research and practice.

It has emerged as the most active field of library and information science during the past few decades. It is estimated that the literature on this topic occupies more than 25% of the total contribution in library and information science. Citation analysis studies form a major portion of it, pertains to the application of bibliometric laws. However, there is a long way to go in achieving perfection in the studies. Even the spread of computer for retrieval, counting and analysis are unlikely to achieve perfection in the studies. This study is merely a method, not a theory. To make it a theory and more useful, researchers must concentrate on the casual factors underlying Bibliometic phenomena. The changes that are frequently occupying in the publication practices are likely to complicate the studies in future. In such circumstances it is advisable to consider the results of such studies as more guidelines rather than ends of themselves.

Bibliometrics is a formal scientific sub-discipline that includes the complex of mathematical and statistical methods, used to analyse bibliographical characteristics of documents. It has been recognized as the structured part of the methodology of library and information science also.

Chapter –2

Telecommunication

CHAPTER 2

TELECOMMUNICATION

INTRODUCTION

End users need to communicate electronically in today's world. People need to exchange data and information electronically with one another. A good communication system is a must of every organization. Organization depends on interconnected networks of computer services, their information processing needs. We live in a networked or connected world. A network is a group of two or more computer systems linked together.

Telecommunication is the sending of information in any form. From one place to another using electronic or light emitting media. Data communication is a more specific term that describes the transmitting and receiving of data over communication links between one or more computer system and a variety of input/output terminals. All forms of telecommunications now rely heavily on computers and computerized devices.

Communication is the transfer of information from one person to another. It is the transfer of the meaning and understanding between two persons. It takes place either verbally or in writing. It could be just one-way or two-way which allows the sender and receiver to interact with each other. A two-way communication is considered better as it establishes understanding through clarity of the message. In an organization, communication may take place in several directions-upward, downward, lateral and diagonal. Similarly

communication can also take place between two computers, one machine sends the data or information and the other receives it. Communication between computers is called data communication. When the computers communicate over telephone connections, the data communication process is called telecommunication. Telecommunication takes place with the "aid of electrical and electromagnetic media (including light waves) as carriers of signals. These media are used to provide world-wide telecommunication networks. A society which is capable of accessing information through telecommunication networks becomes the information society. Telecommunications provide the means by which information is communicated and thereby becomes useful knowledge and of value to' a society. The factors which caused the growth of telecommunication throughout the world are:

(i) Need for information industries to compete among the nations.

(ii) The convergence of the computer and communication technologies providing the growth of information industries.

(iii) The need for round-the-clock communication global networks for multinational corporate operation.

Telecommunications can be used to link two microcomputers so that the owners can talk by typing messages and send data files back and forth. The computer can carry out many different activities through telecommunication:

(i) Organisations, institutions and individuals can produce and read electronic mail (email) messages on their own computers.

Besides e-mail, Electronic Bulletin Boards can be accessed and used for information in general. These informations may consist of notices or documents or computer programmes etc which can be uploaded and downloaded depending upon the requirement.

(iii) Large number of databases can be accessed through the national and international computer networks. These databases may include:

- full texts or abstracts of journal articles in many subject areas,
- full text of newspapers *(e.g. Washington Post),*
- indexes to articles in newspapers *(e.g. The Wall Street Journal)*
- reference indexes *(e.g. Readers Guide to Periodical Literature, the ERIC Education Index)*
- reference tools (e.g. *Grotier Academic American Encyclopedia),*
- court decisions,
- business information,
- commercially available computer programmes and softwares.

TELECOMMUNICATION SYSTEM

Generally a communication network is any arrangement where a sender transmits a message to a receiver over a channel' consisting of some type of medium. A telecommunication system is a collection of compatible hardware

and software arranged to communicate information form one location to another. These systems can transmit text, graphics, voice, documents or full motion video information. The major components of a telecommunication system are:

Hardware: In addition to a hot computer, there is a need for a front-end processor, such as a personal computer or a mainframe terminal. Networks interconnect computer of all sizes and types so that they can carry out their information processing assignments. For examples, a mainframe computer may serve as a host computer for a large organizations's network, assisted by minicomputers acting as network serves for smaller networks of end use microcomputer workstations. Terminals include video display terminals and other end use workstations. The hardware also includes any input/output device that use a network to transmit or receive data. This includes microcomputers, telephones, fax machines, etc. Other communication processors include controllers, multiplexers, moderns and so on.

Telecommunications network:

Telecommunications network includes five principle elements:

i) Terminals e.g. telephone instruments, data terminals, computers etc., which allow the flow of information among them.

ii) Transmission media which facilitate to interconnect the terminals with each other within the network and with terminals of other telecommunication systems through inter-network links.

Switching systems at the internal modes to provide selective interconnections of two or more terminal nodes. In telephone switching networks, the internal nodes are known as central offices or exchanges. The link or telephone line connecting a terminal to a switching system is called a loop. The transmission links interconnecting the different switching systems are called as trunks.

iv) Signaling in which terminals and switching systems send and receive signals to convey the intelligence. Signaling codes and sequences enable the use of telephones to access the network. Consultative Committee on International Telephony and Telegraphy (CCITT), under the auspices of the United Nations is an International Standards body on telecommunication which recommends the practices related to signaling to permit most telephones in the world to be interconnected to any other telephone.

Structure of telecommunication network in which the topology or interconnection of terminals and the switching system nodes through the transmission media are made for the connections for calls.

Telecommunication Software

Software is a virtual component of all telecommunication networks. Communication$ control software includes program stored in the host computer as well as programs in the front end computers and other communications processors. This software controls and supports the communications occurring in telecommunication network. Telecommunication software packages for large computer networks are frequently called

telecommunication monitors or teleprocessing (TP) monitors. Local Area Networks (LANs) rely on software called network operating systems. Many communications software packages are also available for microcomputers

Functions of Telecommunication Software

Telecommunication software packages provide a variety of communications support services. The number and type of terminals, computers, communication processors, and communication, activities involved determine the capabilities of the programs required. The telecommunication software provides several major functions such as:

Access control: This function establishes the connections between terminals and computers in 3 network. The software works with a communication, processor (such as a modem) to connect and disconnect communication, links and establish parameter is such as transmission speed, mode, and direction. This function may also involve automatic telephone dialing and redialing logging on and off with appropriate account numbers and security code, and automatic answering of telephone calls from another computer.

Transmission control: This function allows computers and terminals to send and receive commands, messages, data, and programs. Some error checking and correction of data transmissions may also be provided. Data and programs are usually transmitted in the form of files, so this activity is frequently called file transfer.

Network control: This function manages communications in a network. Software determines transmission priorities, route messages, polls terminals in the network, and forms waiting lines (queues) of transmission requests. It also logs statistics of network activity and resource usage and detects and corrects errors.

Error control: Error control involves detection and correction of transmission errors. Errors are usually caused by distortions in the communication_ channel, such as line noise and power surges. Communication software and processors control errors in transmission by several methods including parity checking. Besides parity bits, additional control codes are usually added to the message itself. These specify such information as the destination of the data, their priority, and the beginning and end of the message, plus additional error detecting information. Most error correction methods involve retransmissions. A signal is sent back to the computer or terminal to retransmit the previous message.

Security control: Security control protects a communication. Network from unauthorized access. Access control software and other types of programs restrict access to data and the computing resources in the network. This restriction usually involves control procedures that limit access to all or part of a network by various categories of users. Automatic disconnection and callback procedures may also be used.

Telecommunication terminals

The most common trades or telecommunication terminals are: telegraph. Telephones, data terminals and computers key systems. Private Business Exchanges (PBXs)

Telegraph: The telegraph is one of the earliest telecommunication systems which is used even today. It works by sending: electric current over a wire. The flow of current is opened and closed with the held of a key by the sender which nulls the key due to an electromagnet at the receiver and causing: it to click. The electrical impulses are either on off long: or short. A code known as Morse Code is used which works on dots and dashes (a dash is three times longer than a dot) to renresent letters. By eliminating: the dot and using: only thc das and calling: the dash a one (1) and the time space a zero (0), the tele1ITanh ca be used as a digital communication system since in the digital communication system two symbols a one and a zero are used.

TELEPHONE

The most important of all telecommunication technologies is the telephone. Unlike the telegraph, the telephone is an analog system; the human voice is converted to an electrical signal that is similar to or analogous to the voice signal. For long distance telephone transmission, amplification of the analog voice signals is required, which at times becomes difficult. On the other hand amplification of digital signals is more simpler. This is one of the reasons why the modern telephone networks are turning to the digital systems.

Telephone system consists of three subsystems; the subscriber loop or the local loop the switching system and the long-distance or line-haul subsystem.

The subscriber or local loop consists of handsets and the cable and twisted copper pair in the local distribution facilities its functions are voice transmission by means of signals, dialing by interrupting the dialing signal; ringing by applying alternating current and hook-off. The local loop, access to the information world would not be possible.

The switching functions of the telephone system are:

(i) to detected the telephone hook-off i.e. indicating when the telephone is lifted off the hook while making or receiving a call;

(ii) to connect the pulse receiver at the exchange or central office to determine the number being dialed;

(iii) to apply the dial tone to signal the caller;

(iv) to make connection to the line specified by the dialing signals. If the dialing signal is within the exchange, then the call is local; and if it is to another exchange then other intermediate switching centres are to be connected;

v) to intimate the calling party by ringing. In case the line is busy, then to .generate busy signal;

vi) to detect the completion of a call i.e. to record when the telephone handset is placed on the hook. The switch breaks the telephone connection.

The introduction of microelectronics and computers in

telecommunications has brought new developments in switching technologies. The manual operations are now replaced by electronic operations.

Line haul or long-distance systems provide transmission paths to carry subscriber to subscriber communications between local exchanges. Much of the research in telephone technologies is devoted to increasing the capacity of the long distance circuits. To increase the efficiency and lower the cost of long-distance calling, new transmission technologies including microwave, satellites and optical fiber systems have been introduced. After the invention of the laser as a source of light, optical transmission systems are being installed in several places. Optical transmission provides almost unlimited bandwidth and can deliver unlimited channel capacity and the glass fibers that carry these channels take up little space and are very cheap. Therefore optical transmission systems are better alternatives to long-distance transmission systems.

Data Terminals and computers

After mid 1980s, a growing trend in use of the public telephone networks to send data 'between computers and remote entry and display terminals is noticed. The transmitted data are encoded into sequences of binary signals and again they are converted into voice signals suitable for transmission over public voice networks. In both the cases special circuits known as modems are interposed between the loop and data terminals to handle the signaling and conversion. More about this are dealt later while describing data transmission techniques.

Private Business Exchanges (PBXs)

Private Business Exchanges (PBXs) or Private Automatic Branch exchanges (PBXs) are private switching systems designed to provide communication of internal

telephones or stations, their numbers, may vary from ten to several hundreds, PBXs serve as switching systems for internal calls and are connected to the public telephone network by a group of external lines or trunks. PBXs have become much more versaiile and smaller in size with the use of integrated circuit technology. Large business firms, universities, hospitals etc have switching systems under Local Area Networks (LANs). These switching systems use a different switching technique known as packet switching which interconnects networks of computers and are efficient and economical for data networks.

Modes of Transmission

Transmission of voice and data can take place in either analog or digital format. Earlier telecommunication networks were based on analog transmission and space-division switching but today the trend is towards digital transmission and digital time-division switching techniques. The later offer more flexibility in the features and services than the former. The digital transmission technique most widely used today, is known as pulsecode modulation (PCM). A number of computer terminals operating interactively with a host computer offer relatively short bursts of communication followed by longer periods of inactivity in contrast to those having voice. communication establishing a path for voice for the duration of the call (Le. Circuit Switching Systems), The traffic in the computer communication systems is handled relatively efficiently with packet switching or noncircuit switching The fastest transmission media operate at the speed of light, 300 million m/s. The two most widely used forms can be classified as bounded media and free space or unbounded media. Both make use of electromagnetic wave propagation as the carrier of signals. Examples of bounded

media are twisted pairs ,of wires, coaxial cables, waveguides, optical fibers (light guides) etc. Free space is utilised for transmission between aerials (antennas) or radiation, sources and sensors.

Switching systems

The basic elements of communication switching system based on circuit switching technique are the switching connection network, the control elements, the signaling elements and the human-machine interface. The function of switching connection network is to set up connection between one telephone loop to other; to service circuits for signaling operations and to trunk circuits for interoffice calls. A centralised mainframe computer, a minicomputer *or* a group of microprocessors form the control element which distributes control over few hundred lines (in villages) to thousands (in metropolitan cities). The signaling elements Le. scanners, distributors and service circuits, help to transmit and receive signaling information *from* loops and trunks. Human machine interface allows the operating, administrative and maintenance personnel to communicate with the system.

Signaling

Once the handset of the telephone is lifted from the hook, the signaling starts. The signaling steps are dial tone, dialing, ringing and answer. Pushbutton telephones using Touch-Tone service have speeded up the element of signaling to a greater extent. Three types of signals are in. vogue, such as,

(i) Alerting signals which include dialtone, ringing, audible-ringing tone and busy-tone

(ii) Address signals which refer to dialed digits starting from the senders telephone to conveying varying formats at the receiver's end.

(iii) Supervisory signals include the signals in the loop circuits and network which the telephone customers are not aware of

Types of telecommunication services

With the introduction of stored program control in telecommunication systems, the variety and convenience of the services have grown substantially. Types of such services are mentioned below.

Customized calling services

Residential or business service from individual telephones is known as Plain Old Telephone (POT) Service. It is the earliest known telephone service provided to customers. Later stored-program control switching systems were introduced. These custom calling services allowed telephone users to have, without special telephones, new control over the use of their telephones. These new services are:

(i) transferring the calls automatically from one telephone number to another,

(ii) when engaged on a call, informing the customer regarding another party's call to reach their telephone,

(iii) using of short 2-or3- digit codes to dial a repertoire of upto 30 different numbers.

Integrated Services Digital Networks (ISDN)

With the digital encoding of voice for transmission and switching, the difference between voice and data are eliminated. Transmission of voice, data and graphics on a single telephone line rather than separately is possible through ISDN. It is possible for a single telephone line to support simultaneously a telephone conversation and data communication to a different distant destination. ISDN capability also helps in handling packet switching operations. The computer transmits the data after breaking them into packets. These packets are redirected by the local switch to individual data terminals for interactive sessions. *ISDN* provides a new form of universal service where voice, data, and other forms of communication" are readly available to all telecommunication.

Telephone conferencing and other applications

Telecommunication services have manifold applications in the field of information technology. The important ones are:

i) internal telephone networks linked to private exchanges which are not found in public networks,

ii) automatic call transfers attending to one call while the other is in progress, paging facilities, prerecord messages, automatic answering, and dictation recording etc.

iii) Telephone conferencing involving the interlinking of more than two parties in a single call, so that everyone can hear everyone else.

Communication among the participants takes place through pushbutton-activated light signals. A telephone 'conference can be combined with a video (television) conference link so that the participants can see each other while speaking.

Other application of telecommunication include remote control in industrial environments, in financial and commercial activities like ordering, business negotiation, news and wire services, message transmission etc, direct-mail ordering (e-mail), cable networking, access to remote information sources, education, training and travel.

Conclusion

The growth of telecommunication technology shows new ways and means of communication for the 21st century. It makes the nations as the developed nations of the world. Therefore. Telecommunication has been able to draw the top priority among the political policies and agenda of the nations allover the globe.

Chapter –3

Bibliometrics: Objectives & Methodology

CHAPTER-3

BIBLIOMETRICS: OBJECTIVES AND METHODOLOGY

1. INTRODUCTION

Bibliometrics has emerged as the most active filed of library and information science during the past few decades. It is a quantitative study based on statistical and mathematical methods. This study is helpful in management of scientific literature, measuring the utility of periodicals and relationship between journals and subject area and also in knowing the most productive contributors in a given filed. Due to interdisciplinary nature of research and trends towards specialization, librarians and information scientists are facing great problems in acquisition, organization and dissemination of information. Therefore, to eliminate these problems there is need of such type of study i.e. bibliometric study.

2. OBJECTIVES

Before starting any study, the objective of the study should be kept in mind by the researcher. The present study aims at identification and describing some of the characteristics of literature published in the field of "Telecommunication" over the period of 5 year (2000-2004) identify the place, language, year, subject area, forms of documents, country of origin from where the document is published.

The present study is based on these main objectives:

(a) To know the most productive country in the field of "Telecommunication".

(b) To know the most common form of documents in a given literature.

(c) To know the language(s) in which the most of literature on the subject has been published.

(d) To know the eminent authors in the field of "Telecommunication".

(e) To know the rate of collaborative research. To identify the scattering of subjects.

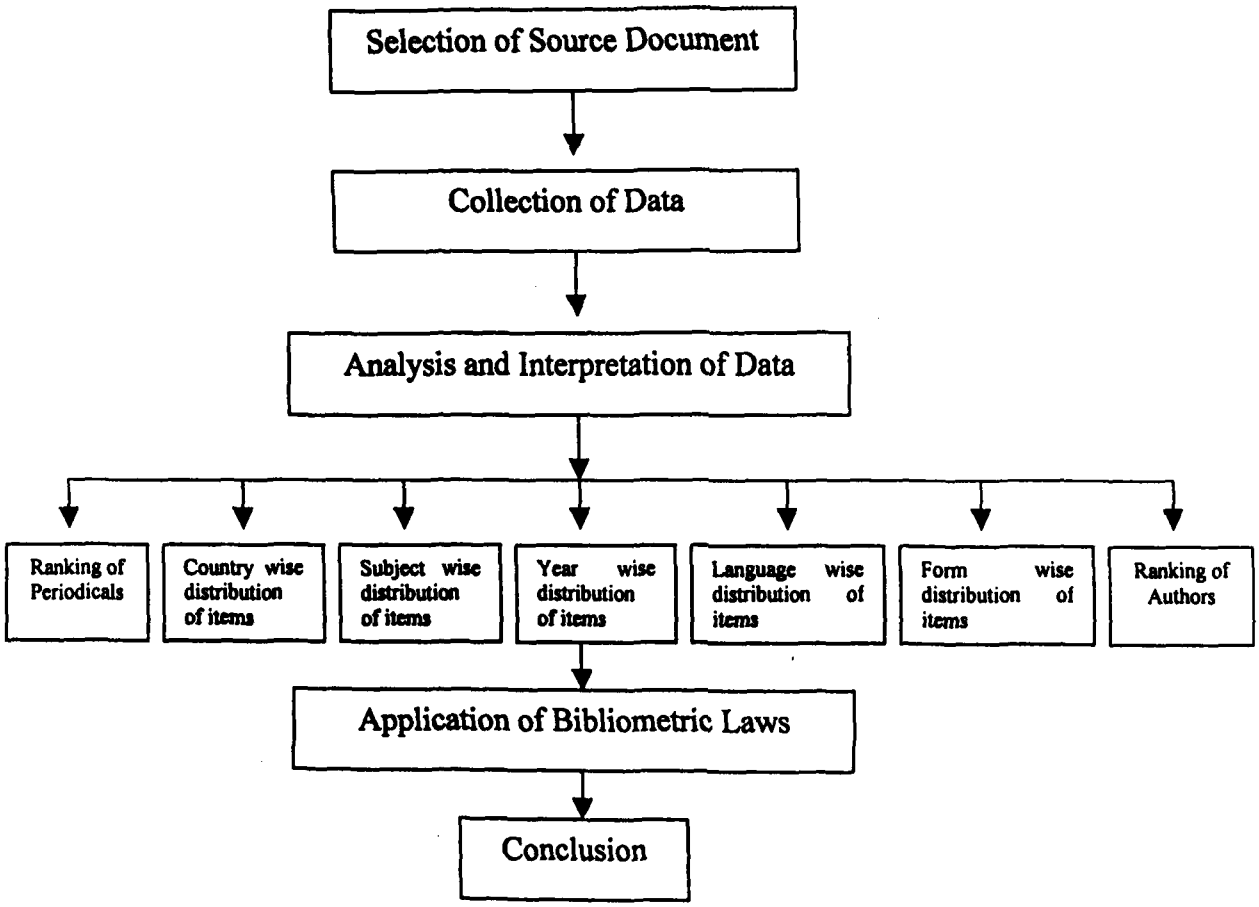
(f) To prepare a ranked list of journals and to find out the core journals in the field of "Telecommunication".

(g) To find out chronological distribution of items.

3. BIBLIOMETRICS: METHODOLOGY

The exponential growth of literature and rapid development of libraries, generated several evolutionary studies about the effectiveness and efficiency of information services. These studies led to the identification and application of appropriate qualitative measuring techniques known as Bibliometrics.

Research in any area calls for systematic methodologies. The methodology for conducting the bibliometric study has been diagrammatically represented below:



3.1 Selection of Source Document

The first step in this study is to select the source document from which the data is toe collected. For this purpose LISA (Librarian Informations Science Abstract), published from UK has been consulted.

3.2 Collection of Data

From the two volumes of Library & Information Science Abstract (LISA) i.e. 2000-2004, 1055 references on the subject "Telecommunication" had been collected on 5×3 (Inches) catalogue cards. Each card contained information about author, title, name of periodical, year place of publication, language and form of document.

3.3 Analysis and Interpretation of Data

All 1055 references (cards) were arranged and rearranged in order to complete the following studies.

3.3.1 Ranking of Periodicals

The main objective of this study is to identify the core periodicals containing the research literature on "Telecommunication". For this purpose, a ranked list of periodicals was prepared.

3.3.2 Country Wise Distribution of Items

It is done to identify the place of origin of documents, which is given in LISA. The entries were grouped on the basis of their place of origin. They were then counted and ranked in a table.

3.3.3 Subject Wise Distribution of Items

Though most of the literature on a given subject is published in core journals but sometimes some material of research value is published in the

journals belonging to related fields. The information about the subject fields of periodicals was obtained from Ulrich's International Periodicals Directory (42nd ed.; 2004). This analysis identifies the core subjects as well as related subjects on the "Telecommunication".

3.3.4 Year Wise Distribution of Items

It is useful to know the occurrence of source documents. This type of study reveals the number of works in a particular year in which the most of the study is conducted. For this purpose a table showing year wise distribution has been prepared.

3.3.5 Language Wise Distribution

In this study an attempt has been made to analyze the language wise distribution of items. Since the source of document is of international level, and have comprehensive coverage and articles are published in almost all languages of the world, so researcher analyzed the items language wise .For the purpose of language wise analysis, the entries were grouped according to their language of origin. After this, they were counted and then prepared a ranked list of languages.

3.3.6 Form Wise Distribution of Items

There are variety of forms of documents like, books, bulletin, patents, articles, report etc. The information regarding the form was collected from LISA, tabulated to find out the most dominant form of literature.

3.3.7 Ranking of Authors

It is done to know the most productive contributors in the subject. For the purpose of ranking of authors the information about all the authors was retrieved, arranged and tabulated in the order of decreasing frequency of their contributions.

3.4 Application of Bibliometric Laws

The whole study depends upon the application of bibliometric laws such as Lotka's, Bradford's and Zipf's Laws. These laws were applied to the analyzed data to check their validity.

CONCLUSION

The last step of this is to conclude the finding of the study.

Chapter –4

Data Analysis Interpretation and Representation

CHAPTER 4

DATA ANALYSIS INTERPRETATION AND REPRESENTATION

Five volumes of LISA (Library and Information Science Abstract) for the year 2000-2005 were consulted for collecting the required data on the topics, 'Telecommunication.' The two volumes carried 1055 items on the subject. The data, so collected was analyzed as under.

1. SUBJECT WISE DISTRIBUTION

According to the law of scattering as explained earlier, most of the material on a given subject appears in certain core journals. However, a significant amount of literature is published in the journals of other related or marginal subject. The analysis pertaining to subject use distribution of items has been done on the basis of subject field of journal, in which the literature on subject is published to find out the subject field of journals "Ulrich International Periodicals Directory, 42nd edition" has been consulted.

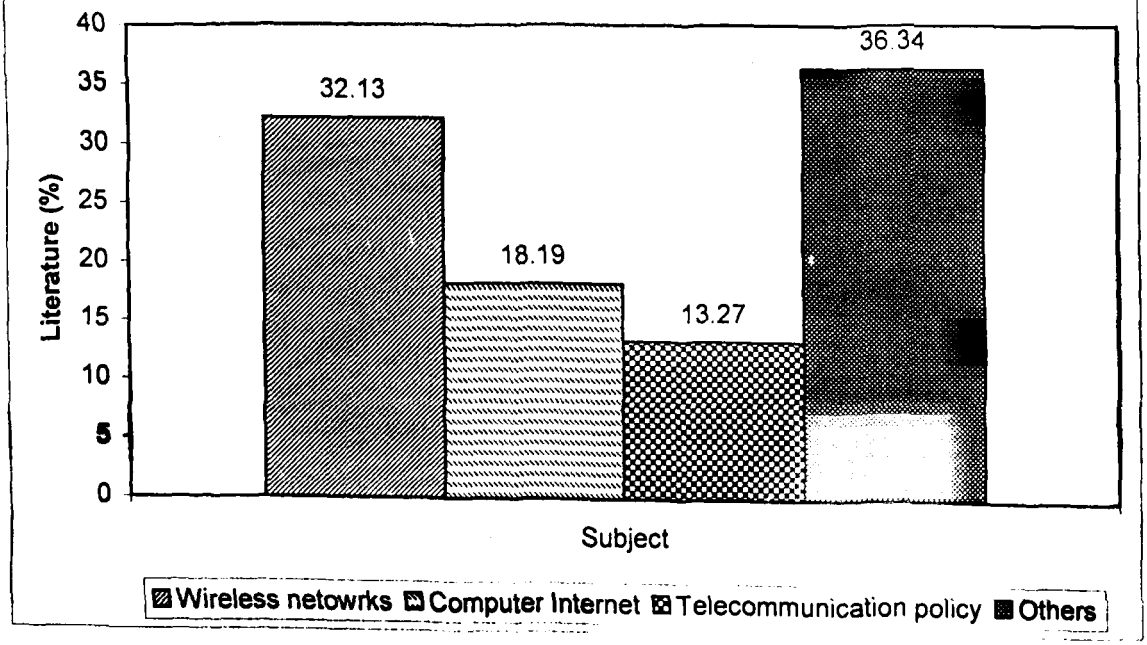
The table shows that the total number of 1055 items appearing in 67 journals, which belong to 15 different subjects. The most dominant subject area was to be 'Wireless Networks' in which 339 items constitutes 32.13%. The second rank goes to 'computer Internet' in which 192 items constitutes 18.19%. The third rank goes to 'Telecommunication-policies in which 140 items constitutes 13.27%.

Table 1: Subject wise Distribution of Items

S.No.	Rank	Subject Area	Frequencies occurrence	Frequency %	Cumulative frequency (%)
1.	1	Wireless Network	339	32.13	32.13
2.	2	Computer-Internet	192	18.19	50.32
3.	3	Telecommunication-Policies	140	13.27	63.59
4.	4	Computer Networks	92	08.72	72.31
5.	5	Communication computer application	47	04.45	76.76
6.	6	Librarian and Information science computer application	42	03.98	80.74
7.	7	Telecommunication management	39	03.69	84.43
8.	8	Computer-Telematics	35	03.31	87.74
9.	9	Communication	27	02.55	90.29
10.	10	Computer-information science and Information	25	02.36	92.65

11.	11	Business theory and economics	20	01.39	94.54
12.	12	Computer-artificial intelligence	17	01.61	96.15
13.	13	Telecommunication Satellite	15	01.42	97.57
14.	13	Education Computer application	15	01.42	98.99
15	14	Technology-comprehensive work	10	00.94	99.93
		Total	1055		

Diagram No.1 Subject wise Distribution of Items



2. FORM WISE DISTRIBUTION OF ITEMS

The analysis of Table no.2 shows that the literature on this subject is published only in one form. It is evident from the data that 1055 items constituting 100% of total data was published in the form of Articles. This may be concluded that the Articles published in journals are most vital forms of media of communication among scientists belonging to the subject "Telecommunication".

Tab 2 Form wise Distribution of Items

S.No.	Rank	Subject Area	Frequencies occurrence	Frequency %	Cumulative frequency
1	1	Articles	1055	100%	100%

3. RANKING OF AUTHORS

The prime objective of this study is to find out the authors whose contribution is significant in the field of "Telecommunication". For this purpose a ranking list of most productive authors has been prepared and presented in the table in order of their frequency of occurrence. It was found that 705 items (66.82%) were written by single authors (i.e. only one contribution) and 350 items (33.18%) were written by multiple authors (i.e. more than one contribution). This shows that the present trend of research is based on single authorship rather than multiple. The first five eminent authors in the field are Adamopouls (D.X.), Cabri (a), Hirt (W), Helfer (J), Eerola (w).

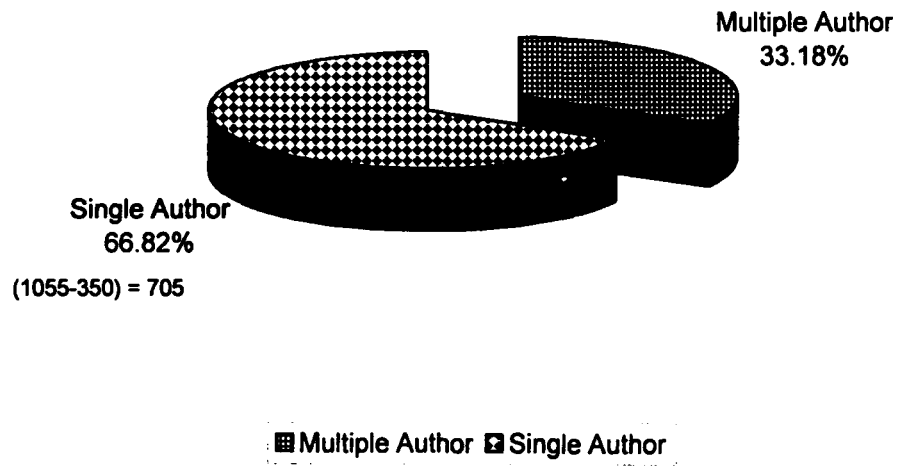
Table 3 Ranking of Authors

S.No.	Rank	Name of Authors	Frequency %	Cumulative frequency
1.	1	Adamopoulos, D.	28	28
2	2	Cabri, G.	20	48
3.	3	Hirt, W.	20	68
4.	4	Helfer, J.	16	84
5.	5	Eerola, W.	12	96
6	6	Kaser, Dick	11	107
7	7	Kokuryo, J.	11	118
8	8	Kona, S.	9	127
9.	9	Wade, V.P.	9	136
10.	10	Wang, F	9	145
11	11	Yoon, S.	9	154
12	12	Marchese, N.	9	163
13	13	Dubis, M.	9	172
14	14	Makki, S.	8	180
15	15	Robins, D.B.	8	188

16	16	Kenyon, R.	8	196
17	17	Ramachandaom, H.	7	203
18	18	Oyebiri, T.O.	7	210
19	19	Owen, D.	6	216
20	20	Ball, W.J.	6	222
21	21	Paltridge, S.	6	228
22	22	Pedersen, K.I.	6	234
23	23	Pritchard, A.T.	6	240
24	24	Schlicke, P.	6	246
25	25	Mendelsolen, S.	6	252
26	26	Tsui, Amy	5	257
27	27	Thompson, J.	5	262
28	28	Ishtiaque, A.	5	267
29	29	Breeding, M.	5	272
30	30	Banerjee, Anirudh	5	277
31	31	Atlee, J.M	5	282
32	32	Gavalas, D.	5	287
33	33	Gerakoulis, D.P.	5	292
34	34	Lilburn, C.	4	296

35	35	Kawagudo, N.	4	300
36	36	Dugan, R.E.	4	304
37	37	Ding, L.	4	308
38	38	Zhang, .	4	312
39	39	Trillas, F.	4	316
40	40	Farahrash, S.	4	320
41	41	Fattah, Hassan	3	323
42	42	Prihandoko, F.	3	326
43	43	Nicholas, D.	3	329
44	44	Hayuard, B.	3	332
45	45	Pagtizs, T.	3	335
46	46	Lehr, Widliam	3	338
47	47	Bruno, R.	2	340
48	48	Yeh, S.	2	342
49	49	Camkell, T.	2	344
50	50	Coers, R.	2	346
51	51	Ahmed, C.B.	2	348
52	52	Moh, W.M.	2	350

Diagram 3: Representing the Authorship Pattern



4. LANGUAGE WISE DISTRIBUTION

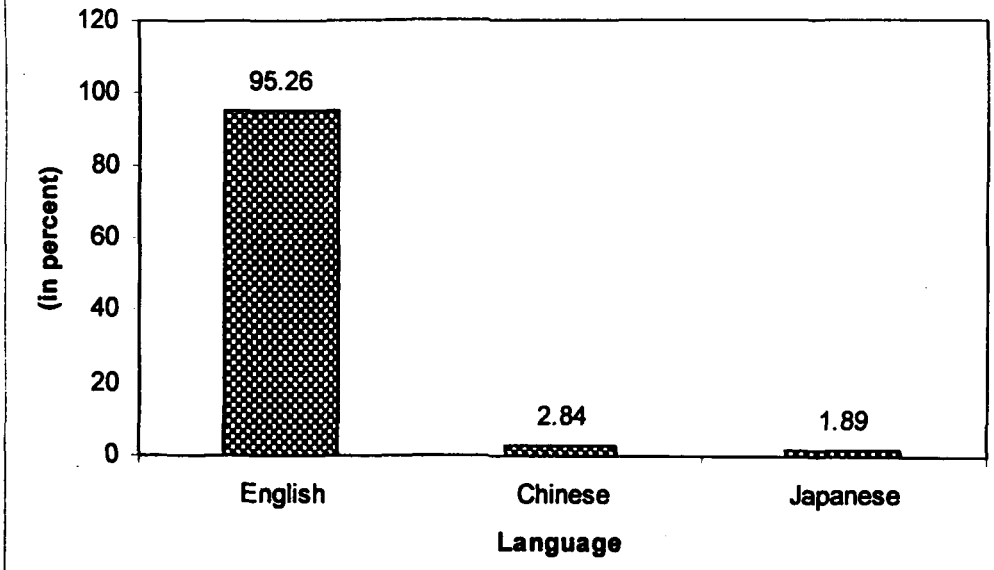
It is always useful for the researchers to know the language in which materials in their area of specialization is published. This type of study provides information about the most dominant language or languages in which the literature on the subject "Telecommunication" is being produced.

Table no.4 shows that distribution of items according to the language of their publication out of a total 1055 items, 1005 (95.26%) were published in English Language. The second and third rank goes to Chinese and Japanese with 30 (02.84%) and 20 (01.89%) items respectively.

Table 4: Language wise Distribution

S.No.	Rank	Name of Language	Frequency	Frequency %	Cumulative frequency
1.	1	English	1005	95.26	95.26
2	2	Chinese	30	02.84	98.10
3	3	Japanese	20	01.89	99.99
		Total	**1055**		

Diagram No.3: Representing language wise distribution of items



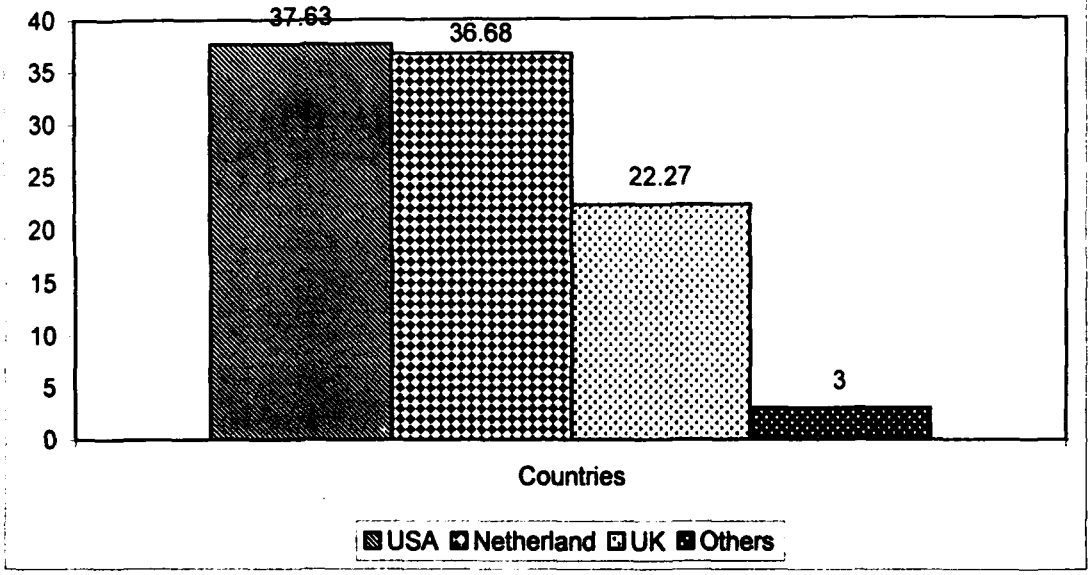
5. GEOGRAPHICAL DISTRIBUTION

Table No. 5 shows list of 17 countries upto 11 rank on literature "Telecommunication". It was observed that 37.63% of total number of journals were published from USA and Netherland and UK produced 36.68% and 22.27% journals respectively. It was found that literature output of USA is more than other countries. In the ranking list USA accounted for 397 of total items i.e. 37.63%.

Table 5: Geographical Distribution

S.No.	Rank	Name of Country	Occurrence	Percentage
1	1	USA	397	37.63
2	2	Netherlands	368	34.88
3	3	U.K.	235	22.27
4	4	German	16	01.51
5	5	Canada	12	01.13
6	6	China	7	00.66
7	7	Denmark	6	00.56
8	8	Finland	3	00.28
9	9	France	2	00.18
10	10	India	2	00.15
11	11	Australia	1	00.09
12	11	Brazil	1	00.09
13	11	Hungary	1	00.09
14	11	Japan	1	00.09
15	11	Kenya	1	00.09
16	11	Singapore	1	00.09
17	11	Sweden	1	00.09

Diagram No. 4: Representing Country wise Distribution of Journals



6. YEAR WISE DISTRIBUTION

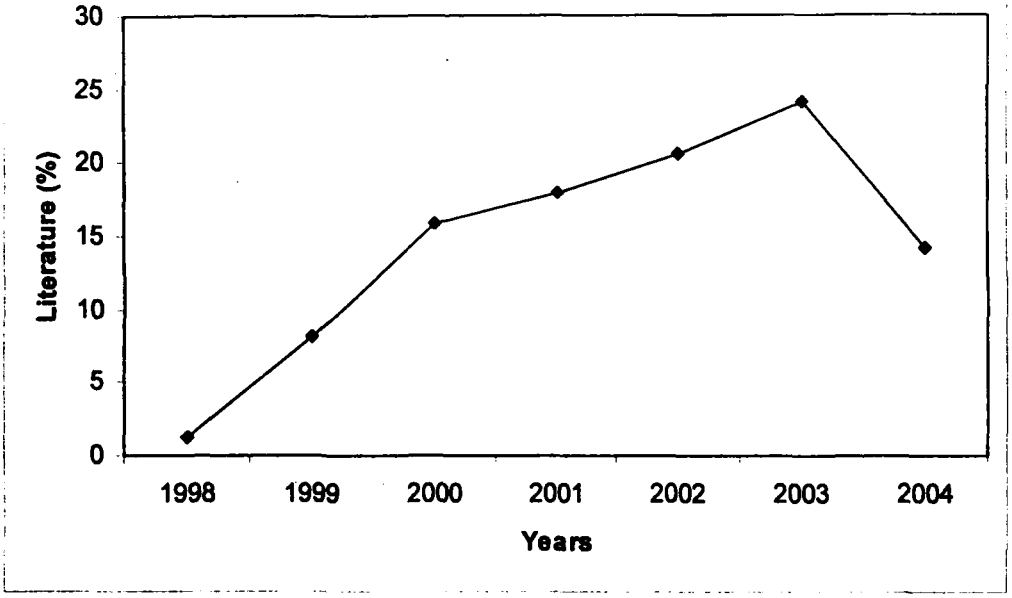
This study is useful in knowing the currency of information in the secondary sources. It may also be useful to know the most production year of the literature on 'Telecommunication'. Through this study it is known that how many articles were published in which year. The information about the period of origin of item can be easily find out by its bibliographical information. As, mentioned, five volumes of Telecommunication (2000-2005) were taken for the collection of data.

Table 6 shows the chronological scattering of all reforms collected from the 'Telecommunication' analysis shows that 23.7%, literature on the subject were produced in 2004, 20.18%, in 2003, 19.8% in 2001, 18.86% in 2002 and 17.34% in 2000.

Table 6: Year wise distribution

Period of origin	Frequency of occurrence					Total freq.	%age Freq.	Cumulative %age Freq.
	2000	2001	2002	2003	2004			
1998	14					14	01.32	1.32
1999	80	3	3			86	08.15	9.47
2000	89	73	2	1	2	167	15.82	25.29
2001		133	49	6	1	189	17.91	43.2
2002			145	65	8	218	20.66	63.86
2003				141	101	242	24.07	87.93
2004					139	139	14.12	102.05
Total	183	209	199	213	251			

Diagram 5: Representing year wise distribution of items



7. RANKING OF JOURNALS

Now a days, journal have got key positions, as an important source of current information, they play a significant role in scientific communication Article of the Journals provide the most of required information of information sources. It may be found that certain core journals contribute most of the literature on particular topic. This information of core journals in various subject will go a long way in preparing the subscription list of journals by the librarian and information scientist. The present study therefore is meant to identify the most important journals, constitution most of the literature of research value in the field of Telecommunication.

In the collected data all the 1055 references were found to be in 67 journals, which have been ranked upto 20 positions on the basis of their decreasing frequency.

This study the first rank was occupied by the journals titled 'computer communication' with the frequency of 125, which accounts for 11.84% of the total reference. Next two positions are occupied by journals like 'Telecommunication Policy' with the frequency 121, which accounts for 11.46% and 'computer Networks' with the frequency of 105, 09.95%.

Table 7 Ranking of Journals

S.No.	Rank	Name of Journals	Place	Frequency	%age frequency
1	1	Computer communications	Netherlands	125	11.84
2	2	Telecommunication policy	UK	121	11.46
3	3	Computer Networks	Netherland	105	09.95
4	4	International Journal of Wireless Information Networks	USA	73	06.91
5	5	New Scientist	UK	59	05.59
6	6	Telematics & Informatics	UK	38	03.60
7	7	Library Journal	USA	33	03.12
8	8	Information World review	UK	22	02.08
9	9	Internet Research: Electronic	UK	20	01.89
		Networking Applications			
10	10	Financial Times	UK	17	01.61
11	10	Computer in Libraries	USA	17	01.61
12	11	International Journal of Human Computer Studies	US	15	01.42

13	11	Computer and Libraries	USA	15	01.42
14	11	Electronic Library	UK	15	01.42
15	11	Information Today	USA	15	01.42
16	11	Information Management Report	UK	15	01.42
17	12	Online	Germany	14	01.32
18	12	Interacting with Computers	Netherland	14	01.32
19	20	Journal of Network & System Management	USA	14	01.32
20	12	Managing Information	UK	14	01.32
21	12	Journal of Information Technology	UK	14	01.32
22	12	First Monday	Denmark	14	01.32
23	12	Government Information Quarterly	UK	14	01.32
24	13	Searcher	UK	12	01.13
25	13	Information Systems	Netherland	12	01.13
26	13	Journal of Data base	USA	12	01.13

		Management			
27	13	Multimedia Information & Technology	UK	12	01.13
28	13	Journal of Medical Systems	USA	12	01.13
29	13	Journal of Strategic information systems	Netherland	12	01.13
30	13	Journal of Medical System	USA	12	01.13
31	14	Journal of Academic Librarianship	UK	10	00.94
32	14	Telecommunication	UK	10	00.94
33	14	Wired	Germany	10	00.94
34	14	Advance technology librarian	USA	10	00.94
35	14	Journal of Medical System	USA	10	00.94
36	14	Medicine on the net	USA	10	0.94
37	15	Journal of Global Information Management	USA	7	00.66
38	15	Journal of Information Technology	UK	7	00.66
39.	15	Teacher Education	UK	7	00.66
40	15	Online and CD notes	UK	7	00.66
41	15	Information and software	UK	7	00.66

		technology			
42	16	Krijastolethi	UK	6	00.56
43	16	Campuswide information system	UK	6	00.56
44	16	Technology Paedology and Education	USA	6	00.56
45	16	Journal Library Administration	USA	6	00.56
46	17	Journal of Information communication and librarian science	USA	4	00.37
47	17	China Society for Scientific and Technical Information	China	4	00.37
48	17	Information watch International	UK	4	00.37
49	18	Medical reference service quarterly	USA	3	00.28
50	18	Journal of knowledge Management	UK	3	00.28
51	18	Journal and use of computer	USA	3	00.28
52	18	Community and Junior College Library	USA	3	00.28

53	18	Informatic professional	USA	3	00.28
54	18	Information Services and Use	USA	3	00.28
55	18	Information Management	UK	3	00.28
56	19	Texas Library Journal	USA	2	00.18
57	19	Knowledge technology and Policy	USA	2	00.18
58	19	Computer journals	USA	2	00.18
59	19	College undergraduate library	USA	2	00.18
60	20	CII Journal Computing & Information Technology	UK	1	00.09
61	20	Information Technology for Development	UK	1	00.09
62	20	School library Journal Summer Supplement	USA	1	00.09
63	20	Scientific American	USA	1	00.09
64	20	FID Review	UK	1	00.09
65	20	Feliciter	UK	1	00.09
66	20	Rural libraries	USA	1	00.09
67	20	Aslib proceedings	UK	1	00.09

Chapter –5

Application of Bibliometric Laws

CHAPTER 5

APPLICATION OF BIBLIOMETRIC LAWS

To check the validity of bibliometric laws over the collected and analyzed data, the next step is the application of bibliometric laws, after their interpretation.

BRADFORDS' LAW OF SCATTERING

This law states that "if scientific periodicals are arranged in order of decreasing productivity of articles on a given subject that may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups, or zones containing when the number of periodicals in the nucleus and succeeding zones will begin as:

$$1 : n : n^2$$

where '1' is the number of periodicals in the nucleus and 'n' is a multiplier. To check the validity of this law 67 periodicals were divided into their zones according to their productivity. In the first zone, 3 journals contained items, in the second zone, 13 journals contained items and remaining 51 journals contained items in the third zone. This analysis shows, phenomenon of scattering of items in different zones of journal.

For all this, data has been taken, from table 7 ranking of periodicals respectively.

The first zone is the nucleus zone as it contains 3 periodicals, followed by 13 periodicals in the second zone, and 51 periodicals in the third zone. These zones, thus identified will form an approximately geometric series as given below:

3:13:5.1

$13 \cong 12 = 3 \times 4$ (Approx)

$51 \cong 48 = 3 \times 4 \times 4$ (Approx)

Therefore, now the series is

$3:3 \times 4:3 \times 4 \times 4$

on substituting $4 = n$

$3:3n: 3n^2$

i.e. $1:n:n^2$ (where '1' is the number of periodicals in the nucleus and 'n' is a multiplier).

Thus, the Bradford's law is proved

Table 8 Bradford's Table

S.No.	Number of Journals	Cumulative no. of Journals	No. of items	Cumulative no. of items
1	1	1	125	125
2	1	2	121	246
3	1	3	105	351
Total	**3**	**Total**	**351**	
4	1	4	73	424
5	1	5	59	483
6	1	6	38	521
7	1	7	33	554
8	1	8	22	576
9	1	9	20	596
10	1	10	17	613
11	1	11	17	613
12	1	12	15	645
13	1	13	15	660
14	1	14	15	675
15	1	15	15	690

16	1	16	15	705
Total	**13**	**Total**	**354**	
17	1	17	14	719
18	1	18	14	733
19	1	19	14	747
20	1	20	14	761
21	1	21	14	775
22	1	22	14	789
23	1	23	14	803
24	1	24	12	815
25	1	25	12	827
26	1	26	12	839
27	1	27	12	851
28	1	28	12	863
29	1	29	12	875
30	1	30	12	887
31	1	31	10	897
32	1	32	10	907
33	1	33	10	917

34	1	34	10	927
35	1	35	10	937
36	1	36	10	947
37	1	37	7	954
38	1	38	7	961
39	1	39	7	968
40	1	40	7	975
41	1	41	7	982
42	1	42	6	988
43	1	43	6	994
44	1	44	6	1000
45	1	45	6	1006
46	1	46	4	1010
47	1	47	4	1014
48	1	48	4	1018
49	1	49	3	1021
50	1	50	3	1024
51	1	51	3	1027
52	1	52	3	1030

53	1	53	3	1033
54	1	54	3	1036
55	1	55	3	1039
56	1	56	2	1041
57	1	57	2	1043
58	1	58	2	1045
59	1	59	2	1047
60	1	60	1	1048
61	1	61	1	1049
62	1	62	1	1050
63	1	63	1	1051
64	1	64	1	1052
65	1	65	1	1053
66	1	66	1	1054
67	1	67	1	1055
Total	**51**	**Total**	**350**	

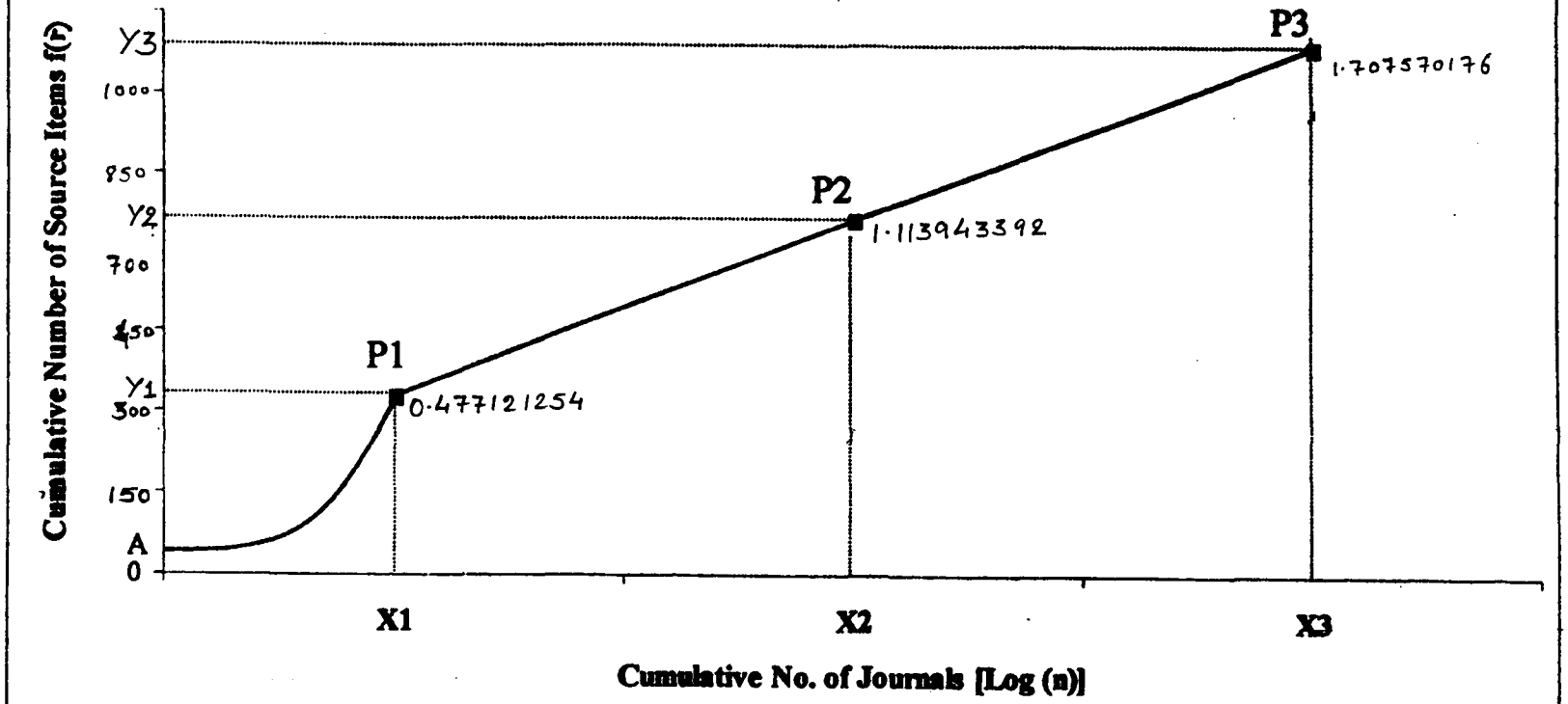
The number of journals in the nucleus can be obtained by plotting f(r) and log 'n' on semi logarithmic graph paper (a bibliograph), where f (r) is cumulative frequency and log 'n' is log of rank of journals as shown in the graph.

The log value of 3 journals in the first zone is 0.477121254. The log value of 13 journals in the second zone is 1.113943392 and the log value 51 journals in the third zone is 1.707570176.

Taking log 'n' on X-axis and number of items in each zone on Y-axis, a graph was plotted as shown. The bibliography, thus obtained, is found to be, by and large similar to **Bradford's Bibliograph**.

As the graph beings as rising curve AP_1 and continues as a straight line. The rising part of graph represents the nucleus of highly productive journals. The point P1, P2 and P3 on Bibliograph are the boundaries of the three equiproductive zones in which almost the same number of articles as the nucleus reprersented by OY1=Y1 Y2 = Y2 Y3 derived from and increasingly larger number of journals represented by OX1, X1, X2 and X2 X3. thus, the Bradford's law is proved.

Diagram No. 5.1
Bradford's Bibliograph



LOTKAS' INVERSE SQUARE LAW

Alfred J. Lotka, in the year 1926, proposed his inverse square law correlating contribution of scientific paper to their number of contribution. According to the law "number of scientists who contributed 'n' paper will be $1/n^2$ of those who contributed only one paper.

In the present study, it was observed that 757 authors have contributed 1055 itms. Out of 757 contributor only 350 authors has contributed more than 1 paper and the rest 705 have contributed only 1 paper each.

Lotkas's laws was applied to known the number of authors contributing 2 papers, 3 papers respectively. Author table papers respectively. Author table has been consulted for derivation

Table

Number of Authors	Number of Articles contributed
705	1
6	2
6	3

Authors contributing 2 papers: As we have that the number of author consisting only one paper is 705, therefore number of authors contributing only 2 papers may be calculated by the formula.

No. of authors contributing 2 papers $= 705 / 2^2 =$ 176.2

The number of authors publishing 2 papers should be 176·2. However, an analysis of the data indicates that only 6 authors have contributed 2 papers which is for less than the figure, obtained applying the law.

Authors contribution 2 papers

On substituting n = 3, in the above formula

No. of authors publishing 3 papers = 705 /3^2

$$= \frac{705}{9} = 78.3$$

The present analysis shows that only 6 authors contributed 3 papers which is again for less than the calculated figure.

It may be concluded that the trend of research now a days have changed as compared to that period. So, on the basis of the analysis of the present data, it is different to satisfy the Lotka's law.

ZIPF'S LAW OF WORLD OCCURRENCE

This law states, "in a long textual matter of words are arranged in the decreasing order of frequency, then the rank of given word of the text will be inversely proportional to the frequency of occurrence of the word.

$r \propto 1/f$ (where, 'r' is rank 'f' is frequency)

$\therefore \quad r = cf$ (where C is constant)

Taking log on both the sides.

Log(r) = Log(c) – Log (f)

Or Log (f) + Log (r) = (c)

Where 'C' is constant

To apply this law, the words (terms) were collected from the title of the article and ranked according to their frequency of occurrence in decreasing order. On application of this law, it is found that log of frequency of occurrence of words when added to log of their rank, the result are almost same for each word.

1. **Word – wireless**

   Frequency – 580

   Rank – 1

   Log of frequency + Log of rank

   Log 580 + Log 1

   2.7634 + 0 = 2.7634

   Log C = 2.7634

2. **Word – Mobile communication**

   Frequency – 180

   Rank – 2

   Log of frequency + Log of rank

   Log 180+Log 2

   2.2552 + 0.3010 = 2.5562

3. **Word** – **Telecommunication**

Frequency – **165**

Rank – **3**

Log of frequency + log of rank

Log 165 + Log 3

2.2174 + 0.4771 = 2.6945

Log C = 2.6945

Thus, it is proved that Zipfs law is valid even today

Table 9

S.No.	Rank	Words	Frequency	Log (C)
1	1	Wireless	580	27634
2	2	Mobile communication	180	2.5562
3	3	Telecommunication	165	2.694
4	4	Computer	135	2.7323
5	5	Networks	125	2.7958
6	6	Digital library	115	2.8387
7	7	Telemetics	95	2.8227
8	8	Information Technology	90	2.8572
9	9	Cable TV	80	2.7923

Chapter –6

Conclusion and Implication

CHAPTER – 6

CONCLUSION AND IMPLICATION

The prime objective of the bibliometric study i.e. quantitative or numerical or statistical analysis of recorded communication, is to know the subject, forms, contributors, languages, countries, years, leading core journals etc. in the subject "Telecommunication". After the collection of data from 'LISA' (Library and information Science Abstract), it was analyzed according to bibliometric technique and results were drawn in the form of table, graphs and pie charts. At last Bradford's Lotka's and Zipf's laws were tested comprehensively.

On the basis of this study major findings may be concluded as follows:

1. The subject description analysis shows the scattering of subject i.e. due to explosion of knowledge new and new subject were developed and this may lead to scattering of subjects. The most dominant subject field in which literature on 'Telecommunication' was produced is 'wireless networks' with 339 items i.e. 32.13%, "computer – Internet" with 192 items, i.e. 18.19%, "Telecommunication Policy" with 140 items 13.27%, computer networks" with 92 items i.e. 08.72%.

2. From the form wise distribution, it is found that Article are to most popular form, it is evident from the data that 1055 items contribution 100% of total data is published in the form of articles.

3. In author wise analysis, it as found that 705 items i.e. 66.82% were written by single authors and 350 items (i.e. 33.18%) were written by more than one authors the most productive authors in this field of "Telecommunication" are:

(i) Adamopolus, D.X

(ii) Cabri, G.

(iii) Thirt, W.

This information will be useful for librarians and user choosing the document

4. Language wise distribution analysis shows that 95.26% literature in this field is published in English language, 02.84% in Chinese, 01.89% in Japanese, English is the most dominant language in this field. This analysis suggested that researchers should known atleast one foreign language other than English.

5. From geographical study, it was found that USA is the biggest producer of new literary warrant in the field of "Telecommunication". It accounts for 37.63% i.e. 397 of the total literature, the second, third and fourth leading. Countries are Netherland (36.68%), UK (22.77%) and Germany (1.51%).

6. From the study dealing in the year wise distribution of items, it is found the largest amount of document were produced in the year 2003 with 242 items i.e. 24.07% on the subject "Telecommunication". The other most productive years are 2002 and 2001.

7. From the table no. 7, it was found that the journal title "computer communications" published from Netherlands is most productive, reporting 125items i.e. (11.84%) of the total, followed by "Telecommunication Policy" published from UK with 121 (11.46%) items and 'computer Networks' with 105 (9.95%) items. The information of core journal in various subject will go a long way in preparing the subscription list of journals by the librarian and information scientist.

8. At last Baradford's Lotka's and Zif's laws were applied to the collected data to testify the validity of laws in the present context. However, Lotkas law could not be verified, as it seens to be out dated for the literature on "world wide web" is concerned. But Bradford's law and Zif's law is valid in the present study.

Finally it may be concluded that Bibliometric study is very well established technique of identification and describing some characteristics of literature. This study helps the librarian or information scientists in deriving certain conclusions, which help them in taking certain fruitful steps in the smooth running of library and also helps in satisfying the need of the users to the great extent. Now a days bibliometric studies are becoming very popular, because of explosion of knowledge.

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